How to identify the ecological habitat network setting up the landscape programme for the state of Brandenburg (Germany)

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Idea

National habitat networks often focus on habitats and corridors beneficial for mammals with large spatial requirements (JĘDRZEJEWSKI et al. 2005, HLAVÁČ & ANDĚL 2002). The current nationwide concept for Germany distinguishes between the habitats of large mammals, the habitats of forest species, of wetland habitats and of dry habitats (FUCHS et al. 2010, RECK & HÄNEL 2011). Constructing the ecological habitat network for Brandenburg we tried to handle a large set of data, which describe more precisely the habitat requirements of typical species there. For the first time several specific ecological networks connecting typical landscape habitats (e. g. small water bodies or bogs) were analyzed on a federal state scale in Germany.

Legislative framework

Each state in Germany is obliged by law to establish an interstate network of interlinked biotopes by the Federal Nature Conservation Act (BNatSchG) covering 10% of the total area. The habitat network has to protect the populations of fauna and flora with their biotopes, habitats and living communities and to maintain, restore and develop functioning ecological interrelationships (§ 21 BNatSchG, 2009). Core objectives are the protection of the biological diversity, securing of minimum habitat patches and connectivity. For this reason "core areas" containing important source populations have to be identified and protected. "Connecting areas" important for the connectivity between the core areas have to be designated and the permeability of these linking areas have to be secured. Areas of necessary development might complement this system. We were the first to integrate the concept of habitat network and corridors strictly into the frame of the law.

The extraordinary biodiversity in Brandenburg is caused by natural richness in a still good connectivity. To preserve and improve this status we analyzed 7 systems of habitat connectivity in Brandenburg.

Habitat network of small water bodies, lakes and rivers
see box below

Habitat network of semi-natural forests
Core: forests protected by law, deciduous forests
Connection: areas surrounding ecologically valuable forests up to 500 m from core areas (FUCHS et al. 2010)

Habitat network of small bogs in forests
Core: rare growing bogs, bog biotopes protected by law, in nature reserves
Connection: areas surrounding bogs located in a max. distance of 2000 m from each other, containing at least 5 core areas on 10 km²

Habitat network of wet grassland and fens
see box below

Habitat network of protected areas
Core: national park, Natura 2000 and natural heritage sites
Connection: areas surrounding FFH-sites (3000 m)
Development: biosphere reserves

Habitat network of dry sites
Core: dwarf-shrubs, dry or semi-dry meadows, open sand patches, common broom
Connection: areas surrounding dry sites in a maximal distance of 1500 m (FUCHS et al. 2010)

Habitat network for mammals with large spatial requirements
see box below

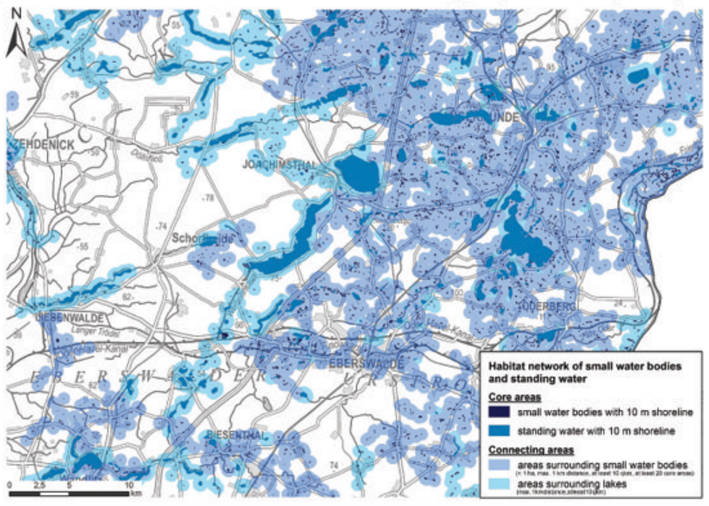
Habitat network of the small water bodies, lakes and rivers


Bombina bombina


Hyla arborea


Pelobates fuscus

A linked net of small kettle holes, ponds and lakes is one reason for the biodiversity of Brandenburg. Amphibians like the common firebelly toad (*Bombina bombina*) und the common tree frog (*Hyla arborea*) depend on such small water bodies (core areas). Since the average travel distance of these species is 0.5 km (SACHTELEBEN et al. 2010, SCHNITTER et al. 2006), it can be assumed that water bodies which are not more than 1 km away from each other allow an exchange of meta-populations. Due to environmental influences not all water bodies are appropriate habitats at the same time. We suggest at least 20 water bodies covering 10 km² to perform a minimum network of this habitat type (connecting area).



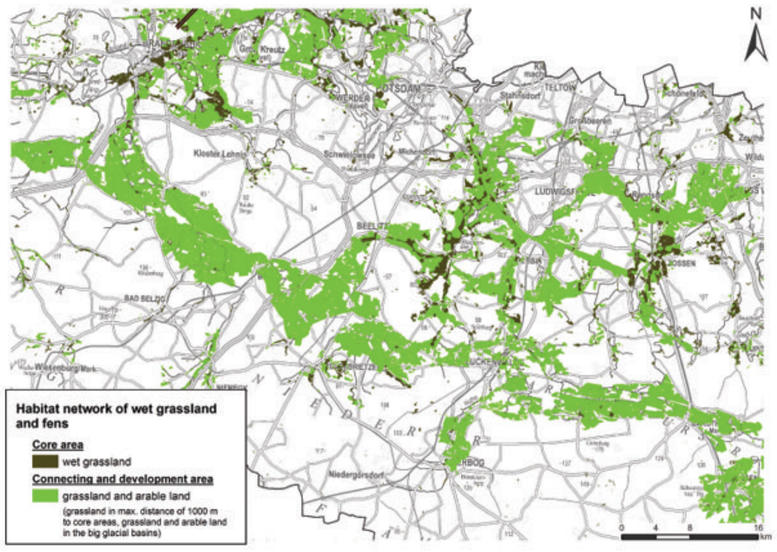
Habitat network of wet grassland and fens


Stethophyma grossum


Lycaena dispar


Melitaea diamina

75 % of the former fens in Brandenburg are in agricultural use. Only 0.1 % of the state surface is still covered by intact growing fens. Due to melioration measures and their use as farmland, some typical species disappeared from the big glacial basins. Some other typical species still persist in the wet grasslands which nowadays are defined as core areas of this habitat network. All other types of grassland may allow the target species to stay there temporarily or use it as stepping stones during migration. Therefore grassland and arable land function as connecting areas.



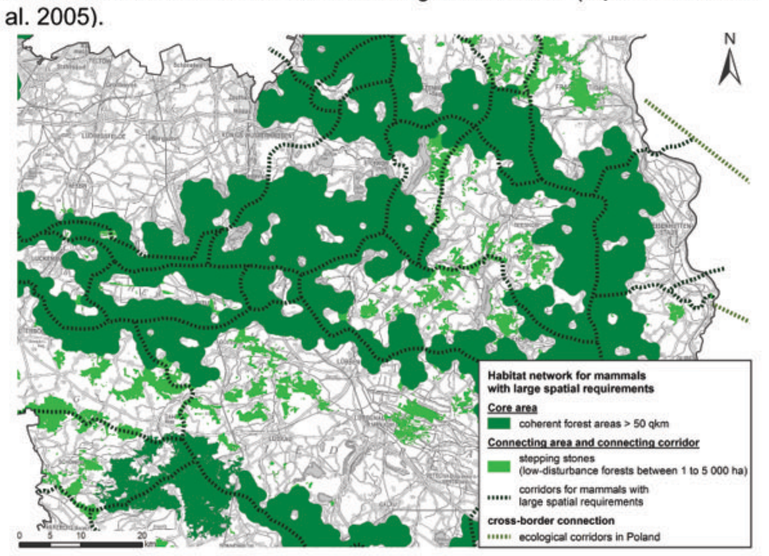
Habitat network for mammals with large spatial requirements


Canis lupus

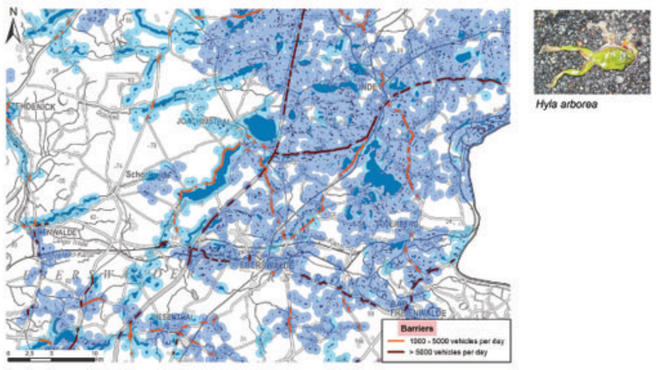

Alces alces


Cervus elaphus

Connected forested areas of more than 50 km² were classified as suitable habitat for small populations of target species like red deer (*Cervus elaphus*) or wolf (*Canis lupus*). Furthermore smaller forest patches may allow these species to stay for some days or travel through. We developed a model (variables: population density, road density, distance to settlements) to predict the level of disturbance within these forest patches and excluded all patches with high proportion of disturbed area. We revised the existing corridor models (FUCHS et al. 2010, HÄNEL & RECK 2011, KLAR 2010) by integrating information on deer path and vehicle collisions given by the hunters association. To ensure also the transboundary permeability the habitat network was linked to the Polish ecological corridors (JĘDRZEJEWSKI et al. 2005).



Barriers



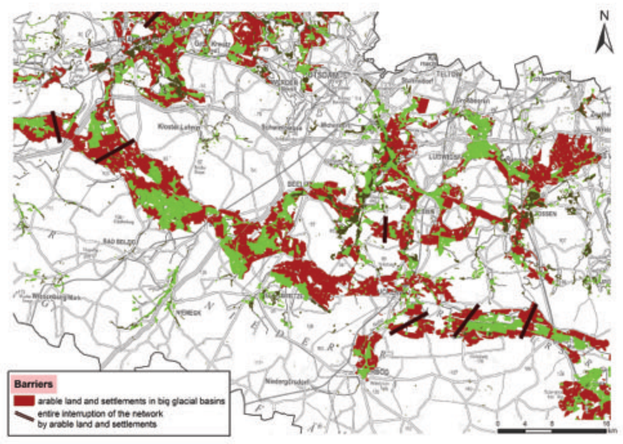
Hyla arborea

Already roads with less than 1000 vehicles per day cause high mortality and a barrier effect for amphibians. We identified the most critical roads in the network system of water bodies in a maximal distance of 250 m of most likely habitats for reproduction.

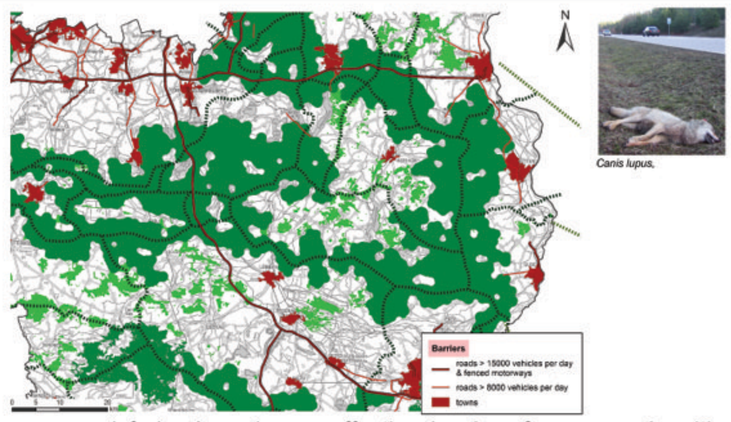
Barriers

Barriers for target species like bog fritillary (*Boloria eunomia*) or false heath fritillary (*Melitaea diamina*) which can not be crossed are settlements and arable land.
But these species could still migrate if there are connecting corridors also they can fly over small gaps. In a corridor a minimal stretch of 50 m should be covered with grassland (connecting area). Gaps of more than 500 m are defined as effective barriers because the connectivity in between populations will be destroyed.
In the map you can see where the network system of grassland and arable land is interrupted by effective barriers.


corn monoculture



Barriers



Canis lupus,

Motorways and federal roads are effective barriers for mammals with large spatial requirements. Roads with more than 8000 vehicles per day are regarded as considerable barriers, roads with more than 15000 motor vehicles per day or fenced motorways can not be crossed at all. Moreover high-speed train lines form barriers as well as settlements. Artificial watercourses can not be crossed if they are equipped with sheet pile walls. A priority concept for wildlife overpasses was set up using these data.

Action requirements

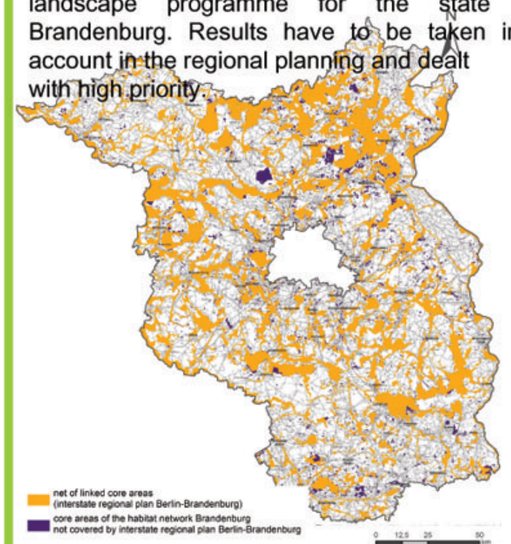
Monitoring several of these roads proved that the model is appropriate to predict conflicts in the habitat network. E. g. in a road section of 1.5 km of the B198 during the spawning migration we spotted 348 amphibians (6 species) in one night being killed by cars (ÖKO-LOG, unpublished data).

The most critical roads should be checked and if a high mortality risk is detected amphibian guidance facilities or temporary diversions should be built. These needs have to be addressed to the local authorities of road construction and nature conservation.


amphibian guidance facility

Action requirements

Using these results we set up the official landscape programme for the state of Brandenburg. Results have to be taken into account in the regional planning and dealt with high priority.




bottleneck at Eberswalde, Germany

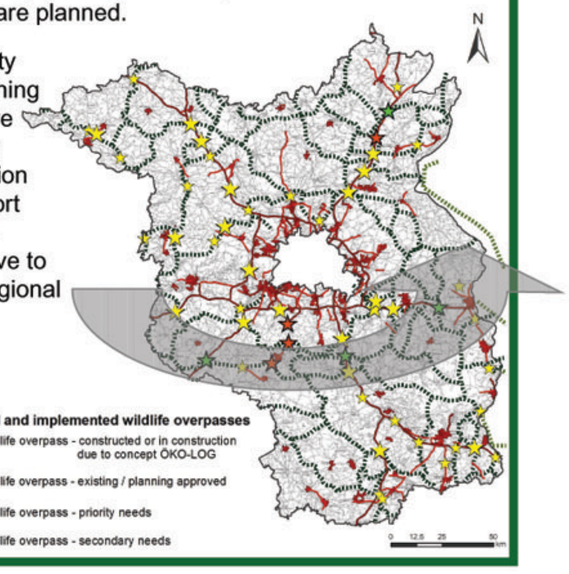
Particularly at bottlenecks where the biotope network axes are narrowed critically or more, the permeability of the biotope network for target species has to be preserved or restored.

Even the interstate regional plan for Berlin/Brandenburg takes care of the requirements as you can see on this figure.

Action requirements

With this concept we already initiated the construction of four wildlife overpasses in Brandenburg state (green stars). As a first step the landscape permeability could be achieved from the western to the eastern border by building three wildlife overpasses across the most heavily travelled motorways in the ecological corridor of South Brandenburg. Next steps are planned.

The landscape permeability has to be restored concerning sections in particular where the corridors become very narrow due to agglomeration of settlements and transport axes. These issues of the landscape programme have to be given high priority in regional planning.




wildlife overpass

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Images:
-Frank Gottwald: *Stethophyma grossum, Lycaena dispar, Melitaea diamina*, corn monoculture
-Mathias Herrmann: *Hyla arborea, Cervus elaphus, Canis lupus*, amphibian guidance facility, wildlife overpass
-Waltraud Wild: *Bombina bombina, Hyla arborea, Pelobates fuscus*
-http://de.wikipedia.org/w/index.php?title=Datei:Bigbullmoose.jpg&filetimestamp=20070818163745: *Alces alces*